## Art. V.—*Description of an Alembic for distilling Amalgam of Gold,* contrived by M. F. Maury, U. S. N.

The common process of treating amalgam, at the gold mines in Virginia, consists in getting rid of the excess of quicksilver, either by straining, or simply by pouring it off, after it has been allowed to stand long enough in a crucible or other vessel, for the gold to settle at the bottom. The latter is the method more generally practiced, though at the *surface* or *deposit* mines, where the gold is found in larger particles, the amalgam is freed from the excess of quicksilver, by holding it between the palm of the left hand and the thumb of the right, and forcing the excess of quicksilver off by pressure. The residuum, a friable mass of quicksilver and grains of gold, contains from twenty to fifty, or even a larger per centum (in weight) of the latter metal; the per centum being largest when the grains of gold are coarse, and least when they are fine. Thus reduced, the amalgam is put into a sheet iron *still,* holding about a pint, or laid in a common shovel, when it is put on the fire, and the quicksilver is "blown off." When the still is used, about twenty five per centum of quicksilver, and some of the gold, are lost; but when the shovel is used, some of the gold, and all of the quicksilver, is lost.

The loss of gold is greatest, when it consists of grains or points impalpably small; for it appears, that that degree of heat, attainable in the operation of "blowing off" the quicksilver, is not sufficient entirely to neutralize the affinity between the two metals. When the gold is *fine,* and the heat quick, much of the former passes off with the mercurial vapor: this is proved by condensing the vapor, and allowing the quicksilver thus obtained to stand for three or four days, when by carefully pouring off the top of it, an amalgam, having the consistency of oil in incipient congelation, is found at the bottom of the vessel. By subjecting this again to the operation of the still, pure gold is obtained. The residuum in this case is about ten per centum of the gross weight of the amalgam.

The metallurgical process of obtaining gold in Virginia is by no means perfect; in every stage through which it passes, from the stamps to the "blowing off" of the quicksilver, there is a wasteful loss of both metals.

All the gold mines yield more in the small than they do in the large way. This difference is the greatest, when the ores are *lean;*

these sometimes give twenty five or fifty and in some instances even seventy five per cent. more of gold by assays made in the closet, than they will yield in the practical way of extracting the metal on a large scale.

Either Chilian mills or *stamps*, commonly the latter, are used for reducing the gangue (slate or quartz) to the state of fine sand; by this operation the larger particles of gold are detached from its matrix, and remain mixed with the sand. The *stamps* are large cast iron pounders, weighing four or five cwt. They tend, by repeated blows, and by keeping up a constant trituration among the grains of pounded quartz, to render the particles of gold, how minute soever these in the first instance may be, still more impalpable.

The gold and sand thus pounded and mixed together, are washed out through a copper sieve, by a constant stream of water from under the stamps, and by it carried thence over several feet of bullocks' hides, resting on an inclined plane, having their hair upwards and the *grain* of the hair turned down stream. The heavier particles of gold, and other weighty minerals, such as the sulphate of baryta, the sulphurets of lead, zinc, iron, copper, and the like, lodge in the hair of the roughly tanned skins, while the sand, and much of the gold in attenuated particles, are carried off together into the waste by the force of the water. At some of the mines the gold is disseminated through the quartz, in particles so minute, that they are seldom visible to the naked eye. When this is the case, much of the precious metal is floated off by reason of its buoyancy. The phenomenon of solid particles of gold being floated on water may be readily understood; for if we imagine a solid cube to be cut from a flake of gold leaf, and this cube to be further diminished by truncation and bevelment, it is very evident, that the specific gravity of this crystal, will not be less than that of the ingot from which the gold beater obtained it; but if it be placed in a vessel of water, in order to sink, it must, in consequence of it and the water not actually touching each other, displace a quantity of that fluid many times greater in volume than the crystal; therefore the latter, whatever its size might be, would not sink, so long as the volume of water to be displaced by sinking, should exceed the crystal in weight. Upon the same principle, a cambric needle will float on water, while the bar of steel from which it was manufactured, will displace several times its own volume of the same fluid, and carry with it to the bottom large pieces of cork and the like.

The gold with the crust and other minerals that do lodge on the skins, is washed off in a tub, whence it is put into a trough, that conducts a stream of water to one or more amalgamators (Tyrolese or Hungarian bowls,) from which is constantly presented another phenomenon in hydrostatics, viz: that of quicksilver rising from the bottom and floating on the surface of water.

Owing to the rotary motion of the amalgamators, the friction of the sand and water against the quicksilver, it tends to separate into minute globes, which rise to the surface, and are floated off; this tendency increases as the quicksilver loses its fluidity and becomes less yielding, which it does by being more and more heavily charged with gold; a considerable portion of which is thus carried off, atom by atom, from the amalgamators.

In the course of twenty four hours, two or three per centum of the quicksilver in each amalgamator is lost. About twenty five per centum of that put in the still, and all that put in the shovel, is lost in the operation of "blowing off." There is a loss of gold in the same operation; besides the gold which swims off in the state of amalgam, that which is carried off by adhering to the sand, and that which is floated off into the waste from the skins, and from the amalgamators.

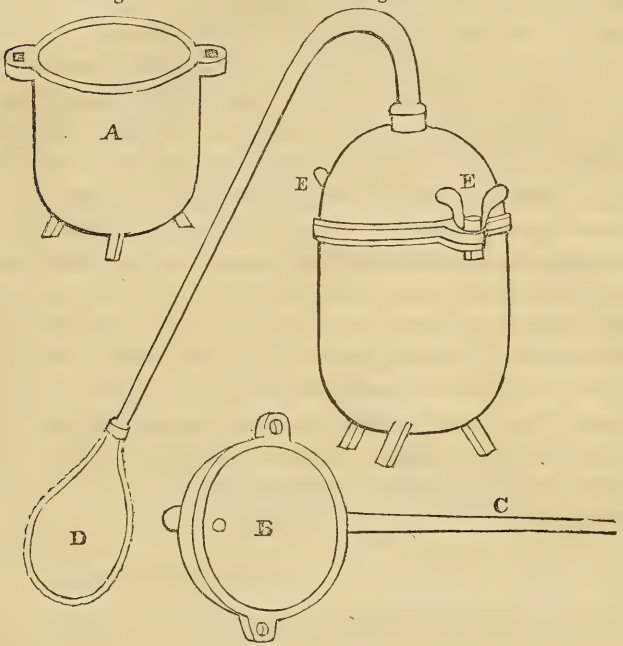
What would be the effect in the amalgamating process, if opposite states of electricity could be induced and kept up between the quicksilver and the gold, until the two metals unite? Would not the tendency to amalgamation be promoted, and in such a case, would not the loss by the floating off the quicksilver and gold be prevented? These questions are proposed, because it is believed that ingenuity is able to supply a practical answer to them. If the metallurgy of gold were better understood, many mines that are now profitless might be advantageously worked.

To save the loss of quicksilver involved in the ordinary process of "blowing off," and to save the gold which escapes with the mercurial vapor, the alembic here described, was invented.

A, is the cucurbit, made of cast iron; it holds half a gallon. B, is the capital, also of cast iron. C, is the beak, made of a gun barrel, bent as in Fig. 2. D, is the condenser, made of India rubber cloth; it was a water bag from the caoutchouc manufactory at Roxbury. The edges of the cucurbit and the capital are ground smooth, so that the escape of vapor may be more easily prevented by luting. The inside of A, is also made smooth, so that the gold may not ad-

here to the bottom of the alembic. The beak is screwed and rusted into the top of the capital so that the joint may be steam tight. In the other end of the beak is a female screw to receive the screw which is in the mouth of the condenser.

Fig. 1. Fig. 2.




After the inside of the cucurbit has been rubbed with chalk, to prevent the gold from adhering to the iron, in case the former should melt, the amalgam is weighed and put in, and the capital put on and screwed down to the cucurbit, by means of the thumb screws E, E. The condenser *uninflated* is then screwed on to the tips of the beak, the joint luted, and the condenser placed in a bucket of cold water. The joint between the head and the body of the alembic is also coated with a luting of horse dung and pipe clay or fuller's earth.

As soon as the amalgam begins to boil, the condenser becomes inflated with the air, which was in the alembic, and when evaporation ceases, the cold air from the condenser now returns into the alembic, and becoming heated, expands and fills the space formerly occupied by itself and the quicksilver. If while the operation is

going on, the heat be suffered not to fall below the boiling point of quicksilver, and the condenser be observed to contract, it is a sure sign that evaporation is no longer going on and that distillation is perfect.

But if the condenser be unscrewed, and the tips of the beak be supposed to remain immersed in water, as soon as the pressure from within (whether by cooling, or from the absence of a fluid to supply vapor,) becomes less than that of the atmosphere without, the water is forced from the bucket through the tube into the alembic, and if the quicksilver be not all evaporated it is wasted, and the alembic is endangered by the concussion and sudden cooling produced within, by the cold water and steam. Therefore as soon at the condenser contracts, the alembic should be removed from the fire, the condenser taken out of the bucket and unscrewed, and the alembic be suffered to cool in the air.

This alembic has been in use at one of the Virginia mines for the last ten or twelve months, and when properly luted, the weight of the gold and quicksilver after distillation has invariably equalled that of the amalgam which they formed previous to the operation. It does away with the necessity of settling and pouring off, or straining, and saves all the gold and quicksilver lost in the common way of "blowing off."

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ART. VI.—*Crystallographic Examination of Eremite;* by JAMES D. DANA, A. M., Assistant in the Department of Chemistry, Mineralogy, &c. in Yale College.

[Read before the Yale Nat. Hist. Society, June 19th, 1837.]

AT our last meeting we were informed by Mr. Thos. R. Dutton, that he had discovered in a bowlder at Watertown in this State, a few crystals of a mineral, which Prof. C. U. Shepard on examination had announced to be an undescribed species; and that Prof. S. had consequently described it as new under the name of Eremite. Through the kindness of Mr. Dutton, I have examined other crystals in addition to the one investigated by Prof. S. and thus am enabled to add farther confirmation of the conclusion that the specimens belong to a species hitherto unknown.

The crystals are all of them small. The largest is but one fifth of an inch long; the others vary in length from one sixteenth to one